DOCUMENTATION REQUIREMENTS
Lined Waterway or Outlet - 468

I. Reference Materials

a. Engineering Field Manual - Chapter Seven
b. ND Supplement to Engineering Field Manual – Chapters Two and Seven
c. SCS-TP-61 - Handbook of Channel Design for Soil and Water Conservation
d. Section IV Technical Guide, Practice Standard 468, Lined Waterway or Outlet
e. Hydrology Manual for North Dakota
f. Soil Survey Report
g. North Dakota Construction and Material Specifications for Conservation Practices
h. Suitable Computer Software:

Waterway Design (e.g. Ohio Program)
Watershed Hydrology (e.g. EFM2, EFH2, TR55)
Excel Spreadsheet Hydrology (e.g. ND-ENG-12e)
Excel Spreadsheet Yardage (e.g. ND-ENG-1e)
ND-DOT Hydrain Series (e.g. HYCHL, HY8)
US-ACOE (e.g. HEC-RAS)

II. Site Investigation/Data Collection

The following is a list of items to be checked in the field:

a. Does proposed lined waterway have an adequate and stable outlet?
b. Determine watershed drainage area, average watershed slope, and weighted cover complex number.
c. Log soils in waterway and review soil survey data. Is salinity a problem? Is there a spring or base flow condition? What makes lining a requirement? Should a Channel design (TR-25) be considered? Drop structures?
d. Check for buried utilities, North Dakota ONE-CALL.
e. Determine engineering job class.

III. Design Surveys

a. Survey notes shall be kept in loose-leaf or bound field notebooks. The notes will be kept in a format similar to that shown in Technical Release 62 and Chapter I, Engineering Field Manual. Electronic survey notes will be documented in a format that allows complete checking by others.

b. The surveyor will use sound professional judgement in gathering information for the design and construction of the grassed waterway. Information will be used to determine waterway grades and estimated quantities.

IV. Design Plans and Specifications

The design of a lined waterway will be in accordance with Standard 468 Lined Waterway or Outlet, Section IV, Technical Guide.

The steps in design are as follows:

a. Plot waterway centerline profile, soils logs, and cross sections on appropriately sized sheets, either hand drafted or CADD developed.

b. Determine 10 year, 24 hour, minimum peak discharge for each waterway reach. Chapter 5 of the Hydrology Manual for North Dakota, Chapter 2 of the Supplement to the Engineering Field Manual, or appropriate software will be used for determining peak "Q's". Form ND-ENG-31e, or computer printout showing all input and output, is required.

c. Determine allowable dimensions, velocities, depths, and design values for materials using tables in Standard 468 - Lined Waterway or Outlet, Section IV, Technical Guide.

d. Check all values using separate methods, such as tractive force/tractive stress, with accepted analytical tools such as HYCHL or manufacturer's data.

e. Determine earth work and seeding quantities. The volume of work in cubic yards will be determined by the method of average cross sectional end area. Computations will be shown, or computer printout of all input and output.

f. NRCS personnel must submit design folder and plans to the State Conservation Engineer for approval prior to installation.

V. Material and Construction Requirements

The cooperator, contractor, and the NRCS cooperator's file will be provided a set of plans and specifications for the waterway construction. The plans can be shown on Form ND-ENG-47e and appropriately sized grid or plan/profile sheets.

The plans will contain, as a minimum, the following:

a. Overall Plan View. This may be superimposed on the location map. Show stationing and identify reaches.

b. Profile - Centerline of waterway. Show original ground superimposed on design grade, stationing, reaches, etc. Centerline profiles are required.

c. Cross Sections - Show typical cross sections for each reach. Cross sections are required at all significant changes in original cross section shapes and grades to calculate quantities.

d. Construction Notes - Add notes to clarify or furnish direction for construction.

e. Quantities - Estimates based on cross sections

Construction specifications are to be provided with each set of plans. The North Dakota Construction and Material Specification for Conservation Practices shall be used for each item of work and material, as applicable or available. Additional specifications may need to be written to provide full material and installation instructions. A cover sheet and list of specifications is to be provided with the specifications.

VI. Layout and Installation Procedures

Layout surveys will be recorded in loose-leaf or bound survey books. Set necessary stakes for at alignment, depth, width, and side slopes. Set grade stakes as needed. Survey notes will be kept in the format as shown in Chapter I - Engineering Field Manual and/or Technical Release 62. Electronic survey notes will be documented in a format to allow complete checking by others.

VII. Checkout

a. Compliance checking - record in field notes.

(1) Record a minimum of one cross section per reach not to exceed 400 feet between cross sections. Cross sections are required at all significant changes in original cross section shapes and grades for yardage computations. Check centerline profile, verify width and depth.

(2) Measure lengths, areas seeded, check all quantities.

(3) Statement of compliance on "as-built" plans - that construction is complete according to plans and specifications, and adequacy or status of vegetation and topsoil placement. Date and sign by individual making determination.